"EXPLORING THE USE OF MICROBIAL ENZYMES IN TEXTILE PROCESSING."

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INTRODUCTION:

When human life began on the earth, food and shelter were the two most important necessities. Later on came clothing.The first materials used for clothing were fur, hide, skin, and leaves. Then there was the birth of a two-dimensional system called FABRIC.Thus was born the “Textile Industry”.

Today the textile industry is one of the largest and most basic industries worldwide.It is the single largest foreign exchange earner for India.The modern textile industry covers different consumer sectors such as apparel textiles, household textiles, medicinal textiles and technical textiles. Textile fibres may be of natural origin as cotton, silk, wool etc or of artificial origin as nylon, rayon and mixed fibres.

Textile processing is a growing industry thathas traditionally used considerable amounts of water, energy and harsh chemicals - starting from pesticides for cotton-growing to high amounts of wash waters that result in waste streams causing high environmental burdens.

Modern society expects biotechnology to be the answer to many worldwide problems like depletion of energy sources, incurable illnesses and pollution, among others. Industrial use of biotechnology, known as white biotechnology, is bringing about new products and processes aimed at the use of renewable resources, as well as the application of green technologies with low energy consumption and environmentally healthy practices.

The use of enzymes in the textile industry is anexample of white/industrial biotechnology, which allows the development of environmentfriendly technologies in fibre processing and strategies to improve the final product quality.

The consumption of energy and raw-materials, as well as increased awareness of environmental concerns related to the use and disposal of chemicals into landfills, water or release into the air during chemical processing of textiles, are the principal reasons for the applicationof enzymes in finishing of textile materials. Textile processing has benefited greatly in terms of both environmental impact and product quality, through the use of enzymes. From the 7000 enzymes known, only about 75 are commonly used in textile industry processes.

The principal enzymes applied in textile industry are hydrolases and oxidoreductases. The group of hydrolases includes amylases, cellulases, proteases, pectinases and lipases/esterases.

Besides hydrolytic enzymes, oxidoreductases have also been used as powerful tools in various textile-processing steps.

Filamentous fungi are capable of producing large amounts of specific enzymes.

OBJECTIVES:

The objective of the experiment was to work on the biobleaching parameter of textile processing.

We specifically focus on oxidoreductases which are capable of either generating peroxide in-situ for bleaching (glucose oxidases), or performing catalytic reactions with hydrogen peroxide as donor such as peroxidases.

The chemical bleaching process commonly in use requires large quantitites of oxidizing agents, hydrogen peroxide, large quantitities of water etc. This increases the pollutant load in the effluents. Oxidizing bleaching agents are members of the halogen family which require CO_2 to release Cl^- which can bring about the bleaching action. Cl^- is a pungent gas which attacks the mucous membranes of nose, throat and lungs.

Bleaching can also be done by peroxides but this needs intense reaction conditions, viz.an elevated temperature (90°C to 100°C) and high concentrations of H_2O_2 and NaOH. H_2O_2 is a viscous fluid having faintly acid reaction and can cause skin blisters.

Further, the bleaching process requires accurate control of the temp, pH, time, pressure etc or it may damage the fabrics itself.

Thus biobleaching process can decrease the environment pollution, replace the harsh chemical methods and also not adversely affect the persons associated with the industry.

METHODOLOGY:

- Different samples (soil / water) were collected and screened for isolation of microbial source (bacterial / fungal).
- 3 bacterial and 2 fungal sources were isolated.
- The potential microbial cultures were identified on basis of decolourization of dye.
- The isolated strain was then tested for shake-flask fermentation (32^OC ;72 hrs / 96 hrs)
- The fermented medium was tested for enzymatic activity (biobleaching)
- Different parameters were tested for the selective enzyme (pH, temp, substrate $conc^n$ etc)
- The enzyme was identified on basis of substrate reactions (color reactions).

RESULTS AND DISCUSSIONS:

Of the different samples tested, one strain was showing potential decolourization on repeated testing.

The fungal strain shows growth resemblance to *Aspergillus sp.* The enzyme of interest was identified to be an extracellular enzyme secreted in active form in the filterate.

The fermented filterate sample (72 hrs& 96 hrs) was tested for biobleaching using gray fabric (cotton). The fabric was incubated in the filterate at 37^{O}C for specified time period.
The whiteness was compared by visual methods.

The final validation of whiteness parameter was done by testing the fabric samples at The Bombay Textile Research Association Laboratories, Mumbai.

The molecular characterization of the isolated strain is under progress.

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